NOTES

INTRODUCTION: PUTTING THE WORLD TO WORK

12. LeMenager, Living Oil; Sheena Wilson, Adam Carlson, and Imre Szeman, eds., Petrocultures: Oil, Politics, Culture (Montreal: McGill-Queen’s University Press,
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24. In disrupting the universality of energy, *The Birth of Energy* also points toward the need for research that would aim to further decolonize energy, which would begin with acknowledging that modern Europe’s claims to scientific invention depended on knowledge drawn from, and through, engagements in the Global South. This book is focused on energy as a Western logic of domination, but in disrupting its claim to universality, it points to the need for a more diverse energy studies. Walter Mignolo, *The Darker Side of Western Modernity: Global Futures, Decolonial Options* (Durham, NC: Duke University Press, 2011); Eric R. Wolf, *Europe and the People without History* (Berkeley: University of California Press, 2010).


CHAPTER I: THE NOVELTY OF ENERGY


3. For instance, Hans Driesch’s vitalism centers upon entelechy as a vital force, though his entelechy differs notably from Aristotle’s. Jane Bennett has excavated Driesch, as well as other vitalist thinkers like Henri Bergson, finding in them precursors to a “vital materialism.” See Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, NC: Duke University Press, 2010), 62–81.


15. Historian Carolyn Iltis notes that “such a philosophical conviction [that something was conserved in nature] is not unusual and is important in the development of other conservation laws.” Carolyn Iltis, “Leibniz and the Vis Viva Controversy,” *Isis* 62, no. 1 (1971): 27.


18. Clarence Glacken argues for Lucretius as a harbinger of concepts in modern physics in *Traces on a Rhodian Shore*. Similarly, in *The Birth of Physics*, Michel Serres argues that Lucretius and the Atomists formulated theories that anticipated complexity and relativity. I would like to thank Beth Mendenhall for suggesting that I consider Glacken in order to distinguish the nineteenth century from deeper historical traditions of knowing the Earth.


25. If humans had instead taken Lucretius’s advice and imbibed his physics, what would our energy systems look like? Perhaps we should find out.

26. Some historians of science have pointed out that early modern science was indebted to the Stoics, and that Isaac Newton in particular was inspired by Stoic physics. See, for example, Peter Barker, “Stoic Contributions to Early Modern Science,” in *Atoms, Pneuma and Tranquility: Epicurean and Stoic Themes in European Thought*, edited by Margaret J. Osler (New York: Cambridge University Press, 1991), and B. J. T. Dobbs, “Newton and Stoicism,” *Southern Journal of Philosophy* 23 (1985), Supplement.


36. Berna et al., “Microstratigraphic Evidence of In Situ Fire.”
39. See, for example, James Scott, Against the Grain: A Deep History of the Earliest States (New Haven, CT: Yale University Press, 2017), and Barry Buzan and Richard Little, International Systems in World History: Remaking the Study of International Relations (New York: Oxford University Press, 2000). Scott amasses archaeological and anthropological evidence that troubles the civilizational narrative by which agriculture leads ineluctably to the rise of the state, a story told as a linear progression of human advancement. Instead, he points out that humans domesticated plants and lived in sedentary communities for thousands of years prior to the rise of the state, and that most were healthier and better off outside the state.
42. Sieferle, The Subterranean Forest, 81.
46. Sieferle, The Subterranean Forest, 135.
48. Sieferle, The Subterranean Forest, 137.
49. Sieferle, The Subterranean Forest, 41.

**CHAPTER 2: A STEAMPUNK PRODUCTION**

11. In his influential essay, “Energy Conservation as an Example of Simultaneous Discovery,” Thomas Kuhn selects a dozen scientists as having the best claim in the discovery, and they range from across Europe.
32. I am grateful to Jane Bennett for suggesting this point.
42. Prigogine and Stengers, *Order Out of Chaos*, 120.
46. Prigogine and Stengers, *Order Out of Chaos*, 120.
52. Meyerson, *Identity and Reality*, 222. Coincidentally, corporate accounting has many tricks for neglecting time to the benefit of corporations, as when oil companies include estimates of future oil supplies, yet to be pumped and often yet to be found, as part of their existing capital.

**CHAPTER 3: A GEO-THEOLOGY OF ENERGY**


5. I would like to thank Jane Bennett for suggesting this term.


11. The most notable exception is Philip Mirowski, *More Heat Than Light* (Cambridge: Cambridge University Press, 1989), which shows how neoclassical economics adopted the terms and ideas of the science of energy.


23. As political theorist Kennan Ferguson points out, “practices of governmentality” depend upon “various conceptualizations of life” that are intertwined with science. He traces the importance of evolution to the formation of political science as a separate discipline in order to show how “presumptions of how life operates . . . underlay the form of politics one privileges and celebrates.” Kennan Ferguson, “The Deep Biology of Politics: A Reminder,” *Political Research Quarterly* 67, no. 2 (2014): 459.


26. Darwin is often associated with the idea of the “survival of the fittest,” but this term did not appear in *On the Origin of Species* until the fifth edition, ten years after the first edition. It was a phrase borrowed from Herbert Spencer, who had used it to describe natural selection in *Principles of Biology* in 1864.


30. Darwin’s mentions of “the Creator” throughout the text were likely in part a response to his religious critics, but they were also a reflection of his own struggle with religion. While Darwin moved away from Christianity over the course of his life, he also writes in an 1879 letter that “in my most extreme fluctuations I have never been an atheist in the sense of denying the existence of a God. I think that generally (& more and more so as I grow older) but not always, that an agnostic would be the most correct description of my state of mind.” His writings leave room for at least a “theistic” account in which God sets natural laws in motion (in that same letter he affirms that theism is consistent with evolution). See Charles Darwin, “To John Fordyce,” May 7, 1879, Darwin Correspondence Project, http://www.darwinproject.ac.uk/letter/entry-12041.


40. Darwin’s *On the Descent of Man* is rife with the racist discourse of its time, often painfully so. However, Desmond and Moore argue that the fundamental drive of Darwin’s work is to argue against apologists for slavery by showing that Africans and Europeans belonged to the same species and were thus biological kin. Adrian Desmond James and Moore, *Darwin’s Sacred Curse: Race, Slavery, and the Quest for Human Origins* (Chicago: University of Chicago Press, 2009).
50. Darwin cites Haeckel in the introduction to *On the Descent of Man*, writing that Haeckel had already laid out most of the ideas Darwin was about to introduce. See Darwin, *On the Descent of Man*, 4.
55. This is evident, for instance, in Darwin’s treatment of plants in Charles Darwin, *The Movements and Habits of Climbing Plants* (London: John Murray, 1875).
64. Verses are from W. B. Yeats, “The Second Coming.”
73. Religion was not the only possible outcome. Entropy was also an inspiration for nonlinear and nondeterministic sciences of the twentieth century that retained a role for creativity in the unfolding of natural processes. See, for example, Ilya Prigogine, *The End of Certainty* (New York: Simon and Schuster, 1997).
78. Isaiah 51:8, in *The Bible*, 813.
89. Tyndall, *Heat Considered as a Mode of Motion*, 434.
99. This is evident, for instance, in the efforts of Thomson and the Philosophical Society of Glasgow to “improve” their industrial city by appealing to the knowledge of the science of energy. See Norton Wise and Smith, “Work and Waste (III).”
CHAPTER 4: WORK BECOMES ENERGETIC

6. Franklin is a fitting representative of the work ethic as it transitioned from a religious belief to a practical virtue. Franklin himself was more interested in how Christianity could inspire a virtuous life, rather than in its dogmatic creeds. He flirted with deism in his youth, and close to his death surmised that, while Jesus was a great moral teacher, he may not have been divine.
20. Rabinbach notes that Taylorism was influential, for example, with Lenin and Antonio Gramsci. Rabinbach, The Human Motor, 239.
26. Marx, for example, refers to an accident caused by overwork in a footnote in Capital, vol. 1, 363.
42. Guthrie, Seed-Time and Harvest of Ragged Schools, 20–21.
43. Guthrie, Seed-Time and Harvest of Ragged Schools, 110.
45. The Remedy for Unemployment, 10–11.
46. The Remedy for Unemployment, 38.
47. Guthrie, Seed-Time and Harvest of Ragged Schools, 20.
48. Mothers continue to arouse suspicion among welfare critics. The racialized figure of the “welfare queen” in the late twentieth century United States was an imagined figure who would have babies simply to avoid waged work.
50. The Remedy for Unemployment, 30.
51. For an exploration of the relationship between energy and slavery, see Andrew Nikiforuk, The Energy of Slaves: Oil and the New Servitude (Vancouver, BC: Greystone, 2014).
CHAPTER 5: ENERGOPOLITICS


5. Anne McClintock, Imperial Leather: Race, Gender, and Sexuality in the Colonial Contest (New York: Routledge, 2013), 112.

6. Thanks to Robert Parks (e-mail correspondence) for pointing out to me that many ecologists intentionally did not seek to study human–nonhuman relations, but instead strove to bracket humans altogether. I am more narrowly interested here in those ecologists who were being taken up by state administrators, or who were themselves seeking to apply their science to human governance.


8. This notion is inspired by Mitchell’s analysis of the emergence of the economy as a political object in the early twentieth century and his argument that economics did not study a preexisting economic system, but rather produced the economy as a site for governance. Similarly, the energy systems into which states intervened were not simply studied but were made by thermodynamics. The implication of this is that different ways of knowing energy would produce different energy systems and governance strategies. Timothy Mitchell, “Economists and the Economy in the Twentieth Century,” in The Politics of Method in the Human Sciences: Positivism and Its Epistemological Others, edited by George Steinmetz (Durham, NC: Duke University Press, 2005), 126–41.


31. In *Imperial Ecology*, Anker claims that, due to a lack of citation of or collaboration with the physical and natural sciences, these sciences “played little role in the ecologists’ understanding of the natural world, despite their use of mechanistic and chemical terminology” (239). However, a lack of citation should not be confused with a lack of influence. Indeed, this claim is belied by the extensive role that energy plays in both schools of ecology that Anker investigates. For example, Anker says of Arthur Tansley, one of the key thinkers in his text, that “It is not always clear whether he is writing about the mind, society, or the environment, but he is certain that this world consists of channels of energy” (31).


34. McKinnon notes that Marx came closest by discussing the replacement of dead labor for human labor, but that he stopped short of considering the full import of energy as, for Marx, “in the last instance . . . value is produced only by human labor.” See Andrew M. McKinnon, “Energy and Society: Herbert Spencer’s ‘Energetic Sociology’ of Social Evolution and Beyond,” *Journal of Classical Sociology* 10, no. 4 (2010): 440.


44. Bentley Allan makes a similar argument about classical science discourses more broadly, showing how the adoption of scientific means affected the political ends of global institutions across modern European history. See Bentley B. Allan, “From Means to Ends: How Scientific Ideas Transformed International Politics, 1550–2010,” PhD diss. (Ohio State University, 2012).


52. Mitchell, “Economists and the Economy.”

53. For instance, Anker notes that Tansley in *Imperial Ecology* was influenced by Sigmund Freud and connected ecology to the study of the human mind. Anne McClintock investigates racialized and gendered attitudes toward women’s labor, social unrest, and urban crowds as they relate to Victorian and Edwardian imperial politics in *Imperial Leather*.


58. Foucault, *The History of Sexuality*, vol. 1, 137.

59. Foucault, *The Birth of Biopolitics; Foucault, Society Must Be Defended*.


69. Foucault was aware of the importance of other scientific disciplines, but explained his focus on medical sciences as stemming from his personal knowledge of them as well as their inherently close connection with social and political institutions.
In one interview, Foucault muses that studying the relationship of “theoretical physics” or “organic chemistry” to politics and society would be “an excessively complicated question” that would “set the threshold of possible explanations impossibly high.” He explains that he therefore chose psychiatry to study both because of his familiarity with psychiatric hospitals but also because its more “dubious” status in science would make it easier to grasp “the intertwining effects of power and knowledge” with “greater certainty.” Foucault, “Truth and Power,” 109.

71. Foucault, Society Must Be Defended, 254.

CHAPTER 6: THE IMPERIAL ORGANISM AT WORK

15. This builds on Walter Mignolo’s study of a “Western code” and its “belief that in terms of epistemology there is only one game in town.” Mignolo, *The Darker Side of Western Modernity*, xii.
18. It should be noted that there is no definitional consensus for empire or imperialism. Julian Go’s definition, which emphasizes power, is compelling: empire is “a sociopolitical formation wherein a central political authority (a king, a metropole, or imperial state) exercises unequal influence and power over the political (and in effect the sociopolitical) processes of a subordinate society, peoples, or space.” Go, *Patterns of Empire*, 7.
25. Praising Chamberlain’s tenure, Lord Alfred Milner, a vehement pro-imperialist, reflected that the turn of the twentieth century marked “the transition from the old system of laissez-faire and stagnation to the new policy of activity and development.” Alfred Milner, “Mr. Chamberlain and Imperial Policy,” in The Life of Joseph Chamberlain (London: Associated Newspapers, 1914), 219.


33. Joseph Chamberlain, “The Changed Conditions since the Repeal of the Corn Laws—Speech Delivered 1903,” in Imperial Union and Tariff Reform: Speeches Delivered from May 15 to Nov. 4, 1903 (London: Grant Richards, 1903), 188.


38. Smuts, Africa and Some World Problems, 49.


49. As just one example, Nature emphasizes the benefits conferred on the colonies by advances in tropical medicine when describing the British Empire Exhibition. See “The Empire of Man.”
53. Tilley, Africa as a Living Laboratory, 17.
54. Smuts, Africa and Some World Problems, 46.
55. Grant, A Civilised Savagery, 2–3.
60. Spillers, Black, White, and in Color, 440.
72. Césaire, Discourse on Colonialism, 70.
73. Césaire, Discourse on Colonialism, 19.
74. Césaire, Discourse on Colonialism, 36.
75. Césaire, Discourse on Colonialism, 35–36.
76. Cannadine, Ornamentalism: How the British Saw Their Empire, 5.
77. Cannadine, Ornamentalism, xix.
81. Adas, Machines as the Measure of Men, 146–48.
84. Mary Kingsley, West African Studies (London: Macmillan, 1899), 386, quoted in Adas, Machines as the Measure of Men, 147.
86. McClintock, Imperial Leather, 57–58.
90. McClintock, Imperial Leather, 48.
91. McClintock, Imperial Leather, 49.
95. McClintock, Imperial Leather.
96. McClintock, Imperial Leather, 53.
97. McClintock, Imperial Leather, 56.
98. McClintock, Imperial Leather, 252.
100. For an example, see S. F. Markham, Climate and the Energy of Nations (London: Oxford University Press, 1944).
102. Similarly, Morton notes that “world is an aesthetic construct that depends on things like underground oil and gas pipes.” Timothy Morton, Hyperobjects: Philosophy and Ecology after the End of the World (Minneapolis: University of Minnesota Press, 2013), 106.
103. McClintock, Imperial Leather, 162.
104. McClintock, Imperial Leather, 162.
105. McClintock, Imperial Leather, 252–53.
107. McClintock, Imperial Leather, 211.
110. Césaire, Discourse on Colonialism, 42.
111. Césaire, Discourse on Colonialism, 42–43.

CHAPTER 7: EDUCATION FOR EMPIRE

2. Henry Dyer was another early leader in setting up Japanese engineering programs. He, too, was recommended to the Japanese government by one of the luminaries of thermodynamics—his mentor, William Rankine.


6. The visiting journalist from the *Japan Weekly Mail* notes that Ayrton’s laboratory housed “an apparatus to test a well-known Japanese belief regarding the effect of an earthquake on a magnet.” “A Visit to Professor Ayrton’s Laboratory,” *Japan Weekly Mail*, October 26, 1878, 1130.


14. “A Visit to Professor Ayrton’s Laboratory,” 1129.


16. “A Visit to Professor Ayrton’s Laboratory,” 1130.

17. Anyone who has taught children knows this instinctively to be true. The Reggio Emilia philosophy of early childhood education, for example, refers to the classroom as the third teacher. A minimalistic, organized classroom is more enticing to children, who will play more creatively and with more focus in such a space.


19. “A Visit to Professor Ayrton’s Laboratory,” 1130.


22. My own university, Virginia Polytechnic and State Institute, or Virginia Tech, also emerged in this period. Originally named the Virginia Agricultural and Mechanical College (1872), it adopted the more modern-sounding Polytechnic Institute in 1896.


28. Henry Towne, “Industrial Engineering,” address, Purdue University, Indiana, February 24, 1905.
42. Armstrong, *The Hampton Normal and Agricultural Institute*.
52. Bryce, Economic Crumbs, 2–3.
54. Bryce, Economic Crumbs, 37.
62. The Indian Helper, May 27, 1887.
73. The Indian Helper, April 13, 1888.
74. The Indian Helper, December 18, 1885.
CONCLUSION: A POST-WORK ENERGY POLITICS


21. This very conclusion also succumbed to the listicle urge.
27. Srnicek and Williams mention the environment and energy, but only glancingly.
44. Weeks, *The Problem with Work*, 221.
47. Weeks, *The Problem with Work*, 139.
51. Lord, “Why Basic Income Can Save the Planet.”
54. Daggett, “Petro-Masculinity.”

57. Daggett, “Petro-Masculinity.”


59. Lord, “Why Basic Income Can Save the Planet.”